

**WHAT IS CLAIMED IS:**

1           1.     A process comprising:

- 2               a)     exposing a chemical species to nanoparticles such that said chemical  
3                       species adsorbs onto a surface of the nanoparticles as a chemical  
4                       adsorbate;  
5               b)     irradiating the nanoparticles comprising the chemical adsorbate with  
6                       radiation;  
7               c)     detecting altered photoluminescence properties of the nanoparticles  
8                       comprising the chemical adsorbate; and  
9               d)     analyzing the altered photoluminescence properties by comparing to  
10                      one or more pre-defined altered photoluminescence properties, to  
11                      provide for an identifying of the chemical species.

1           2.     The process of claim 1, wherein the radiation comprises ultraviolet radiation.

1           3.     The process of claim 1, wherein the nanoparticles comprise quantum  
2           confined nanoparticles.

1           4.     The process of claim 1, wherein the nanoparticles comprise silicon  
2           nanoparticles.

1           5.     The process of claim 1, wherein the one or more pre-defined altered  
2           photoluminescence properties are provided by exposing nanoparticles having initial  
3           photoluminescence properties to one or more known chemical species.

1           6.     The process of claim 1, wherein the chemical species is selected from the  
2           group consisting of toxins, carcinogens, mutagens, lachrymators, flammable species, nerve  
3           agents, explosives, and combinations thereof.

1           7.     The process of claim 1, wherein the adsorption of a chemical species onto the  
2     surface of the nanoparticles comprises a reversible process.

1           8.     The process of claim 1, wherein the nanoparticles range in size from about 1  
2     nm to about 100 nm.

1           9.     The process of claim 1, wherein the nanoparticles are present in an aerosol.

1           10.    The process of claim 1, wherein the detecting the altered photoluminescence  
2     properties comprises utilizing a wavelength selective detector.

1           11.    The process of claim 1, wherein the analyzing the altered photoluminescence  
2     properties comprises utilizing a wavelength selective detector.

1           12.    The process of claim 1, wherein the detecting and analyzing the altered  
2     photoluminescence properties comprises utilizing a spectrometer.

1           13.    The process of claim 1, wherein the detecting and analyzing the altered  
2     photoluminescence properties comprises utilizing an optical filter.

1           14.    The process of claim 1, wherein the nanoparticles are silicon nanocrystals.

1           15.    The process of claim 1, further comprising determining a concentration of the  
2     chemical species.

1           16. A process comprising using nanoparticles as taggants for material  
2 identification.

1           17. The process of claim 16, wherein the material is selected from the group  
2 consisting of toxins, carcinogens, mutagens, lachrymators, flammable species, nerve agents,  
3 explosives, and combinations thereof.

1           18. The process of claim 16, wherein the taggants are used in anti-counterfeiting  
2 applications.

1           19. The process of claim 16, wherein the identification is based on properties  
2 unique to the nanoparticles.

1           20. The process of claim 19, wherein a unique property is photoluminescence.